

Description of the Operational Mechanics of a Basel Regulated Banking System

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Abstract

This paper presents a description of the mechanical operations of banking as used in modern banking systems regulated under the Basel Accords, in order to provide support for a verifiable and complete description of the banking system suitable for computer simulation. Feedback is requested on the contents of this document, both with respect to the operations described here, and any known national, regional or local variations in their structure and practice.

1 Introduction

There appears to be considerable confusion surrounding the precise operation of the modern banking system, in particular with respect to the regulation of lending and deposit creation, the handling of loan defaults, and the relationships between holdings at the central bank and the bank clearing system and the rest of the system.

Simulation of the aggregate behaviour of the banking system is well within current computing capabilities, and would be highly beneficial both in exploring the impacts of different regulatory frameworks on the behaviour of the system, and to provide a scientific foundation for economic understanding of the monetary system. However for simulation efforts to be successful an accurate description of the mechanical operations used by banks in their day to day operations is required and this does not appear to be currently available either within economic theory, or from the regulatory authorities. The descriptions that are currently provided by economic textbooks such as Mankiw [1], and McConnell [2]. are notably deficient, with important aspects of the system such as the precise handling of loan repayments and loan defaults omitted.

This paper aims to provide a clear and verifiable description of the fundamental operations of the banking system, which can then be used to build accurate simulations of its behaviour. We present these operations following the example of late 19th and early 20th century bookkeeping manuals on banking such as Shand [3], by providing detailed descriptions of the fundamental bookkeeping operations performed by a bank as it processes deposits, lends money, receives repayment on loans, and handles loan defaults in a banking system that consists of two banks, A and B, and a central bank.

2 Double Entry Bookkeeping.

Banking as we understand it today has emerged over several centuries from a set of practices first established in Northern Europe by medieval goldsmiths and traders [4]. It initially developed as a form of statistical multiplexing whereby access to physical money in the form of gold was managed through day to day bookkeeping practices, operated under the assumption that only a fraction of the underlying liabilities (customer deposits) would be requested at any one time. Based on this assumption, goldsmiths would make short term loans of gold to other customers, and as the chits used to represent gold deposits began to be exchanged directly a bank based monetary system developed. Over time this system has mutated into today's almost entirely electronic transfer based system, however it still retains the bookkeeping practices of the original system, in particular with respect to the relationship between customer deposits, and interbank liabilities both in the form of reserves at the central bank, and deposits held with other banks in the system. The historical antecedents of the system are significant, as several of its current features can probably only be appreciated within that context.

The mechanical operations used by banks in their day to day processing of money and loans, are in large part a creation of the double entry bookkeeping procedures that evolved to track the customer deposits of physical money, and the associated lending activities of the banks. Double entry bookkeeping is based on the principle that a general ledger of assets, liabilities and shareholder equity is constructed from a series of separate accounts or individual ledger books (commonly referred to as T-accounts when presented formally). The system of accounts for any bookkeeping entity is deliberately structured so that a separate and opposite entry must be made into two T-account simultaneously for each action that occurs. That is for each debit in one T-Account there must be a separate matching credit in a different T-account, and vice versa. The practice was developed by the Florentines in the 13th century, initially as an anti-fraud measure, since the separate updates to two separate books could be structured to require different people to maintain the entries in each book.

In accounting assets are generally the resources owned by a company, and liabilities are resources that the bank owes to another separate entity. Customer deposits at a bank for example, are classified as liabilities, but when physical cash is deposited at the bank this is classified as an asset, with the corresponding liability being the customer deposit that was created by the deposit of physical money. The terms debit and credit have very specific meaning within bookkeeping that are tied to the type of account being operated on. For example, debits to accounts classified as dividends, expenses, assets and losses cause the account's balance to increase, whilst credits to accounts classified as income, revenue, liabilities and stockholder's equity cause these accounts to be increased. Debits are listed for all accounts in the left hand column, and credits in the right.

Cash		Deposit		Balance	
Debit	Credit	Debit	Credit	Asset	Liability
100			100	100	100

Table 1: Example of T-Account Cash Handling

The balance sheet of assets, versus the liabilities and equity of a bank is built up from the set of individual T-accounts. In order to maintain this balance, each T-account is classified as either an asset or a liability. Increases to an asset T-account are then recorded on its debit side, and decreases as credits; whilst increases to a T-account classified as a liability are recorded as credits and decreases as debits. Table 1 shows an example of this when physical cash is deposited at a bank. Two entries are made, a debit into the bank's vault cash account which is classified under assets, and a credit into the customer's deposit account as a liability. The balance of both T-accounts consequently increases, maintaining equality in the balance book.¹

As a consequence the structure surrounding the classification of T-accounts as liabilities or assets can be somewhat unintuitive. Revenue and capital for example are typically treated as liabilities, with the justification that capital and profits are 'owed' to the shareholders, although more prosaically this treatment is also required to maintain the balance of bookkeeping operations. Similarly the handling of loan defaults by banks uses a 'contra-asset' account, which allows income to be reserved on the Asset side of the ledger against expected losses. As a result money is removed from the income accounts, that would otherwise be evaluated to determine profits and paid as dividends to shareholders.

3 Bank Model

Economic models of bank operations are frequently presented at the annual balance sheet level, following the basic accounting identity:

$$Assets = Liabilities + Stockholder's Equity \quad (1)$$

However, correct analysis of banking behaviour requires a consideration of the details of monetary flows within the banking system in their day to day operations, particularly with respect to the handling of loan defaults, which are hidden by this 'identity'. The expanded versions of equation 1:

$$Assets = Liabilities + Common Stock + Retained Earnings \quad (2)$$

and

$$Assets = Liabilities + Common Stock + (Income - Expenses) - Dividends^2 \quad (3)$$

¹American and English accounting practices reverse the credit/debit convention, in the English system increases to an asset account are recorded as a credit. In this document we follow the American conventions.

²There are potential order of evaluation issues with this equation if bracketing is not treated strictly. It perhaps might also be observed that units are not being correctly treated by the equality in the equation, and this may cause issues for superficial analyses based on it. For example,

Analysis of the banking system is further complicated by the increasingly abstract nature of money, as the banking system continues its evolution away from physical money to a completely electronic system. The system was originally based on empirically derived but known ratios between physical money, the price of precious metals, and the quantity of bank loans made at each local bank, regulated by the requirement that a fixed percentage of reserves against deposits was required to be held at the central bank.³ While it is not completely correct to equate bank deposits with physical money, if for no other reason than accounting treatment of the two differs significantly, it is equally invalid to fail to acknowledge the role bank deposits play as the de facto money supply in determining the general price level, and indeed have done for over a century [7].

4 Bank Operations

Table 2: Initial Position for Bank Operations

Examples in this document are based on a banking system consisting of two Banks, A and B, and a simplified Central Bank. The general ledgers of the two banks are shown together with their reserve account relationship with the central bank. The other holdings of the central bank are not shown. The starting position used for the examples in this document is shown in Table 2. For the examples shown here, the 2% reserve required of European

³The description commonly found in economic textbooks such as Mankiw [1], which appears to have been derived from the 1931 Macmillan Report to the British Parliament [5], probably authored by Keynes [6], incorrectly shows a reserve being withheld from the total customer deposits at the bank, rather than as additional funds owned by the bank and maintained in a fixed relationship to the quantity of money represented as deposits.

Banks on accounts with notice periods up to 2 years is used. It is assumed all deposit accounts at both banks fall within this classification⁴. Reserve accounts held by banks at the central banks are treated as deposit accounts by the central bank, and are consequently classed as liabilities of the central bank. A matching amount of central bank assets is shown for completeness.

Cash, cash equivalents and reserves represent the bank's own money, its 'liquidity'. Although originally this would have involved significant holdings of physical cash, today these holdings are predominantly electronic, and their significance derives from their position in the system of ledger books in maintaining receipts as funds flow between banks, rather than directly from customers. Money paid into or out of the bank is funnelled through its cash asset journal, with a matching credit or debit in the account the money is processed for. In an era of electronic operations, this part of the bank's operation can be classified as a vestigial structure derived from gold standard era operations, but one with significant implications for the behaviour of the larger system.

4.2 Fundamental Operations

The following list of bookkeeping operations describe the fundamental mechanical actions that any bank must perform to maintain its day to day operations. Potentially some of these actions, such as transferring money between accounts can be performed differently when done at the same bank, than when done between banks as opposed to at the same bank, and consequently both possibilities are described.

1. Transfer between accounts at different banks, i.e. cheque or EFT
2. Transfer between accounts at the same bank.
3. Lend money to a customer.
4. Lend money to a customer at a different bank.
5. Borrow from another bank (or central bank)
6. Payment of interest and capital on a bank loan
7. Write off a loan
8. Increase Capital Holdings
9. Increase Reserve Holdings
10. Central Bank Operations
 - Borrow from the Central Bank (Lender of last resort)
 - Payment of interest on reserves at the Central Bank

In the examples below, we first show the set of (credit, debit) tuple operations that are performed using the American convention (increases in assets are debits), and then a worked example following the initial position in Table 2.

⁴Source: European Central Bank, <http://www.ecb.int/mopo/implementation/html/calc.en.html>

4.3 Transfers between Bank Accounts

4.3.1 At the same Bank

When money is transferred between two accounts at the same bank it is a debit to one account, and a credit to the other, with no change to the aggregate liability for the bank shown on the balance sheet.

Operations

1) debit customer account (A.C1) credit customer account (A.C2)

Table 3: Transfer between accounts at same bank					
Central Bank		Bank A			
Assets	Liabilities		Assets	Liabilities	
400	200	Loans	10000	4000	Deposit A.C1
				6000	Deposit A.C2
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	11000	11000	
		Bank B			
		Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
	200	Reserves	200		
		Cash & Eq	800	1000	Capital
400	400	Total	11000	11000	

This is in contrast to the procedure used when money is explicitly transferred between different banks shown in section 4.3.2, which could also be applied to a transfer occurring between customers at the same bank. While it may seem unlikely that there would be such dramatically different treatment, the potential certainly appears to exist, and this would have systemic implications if allowed.

It is also not known what if any differences in treatment occur when transfers are performed between branches of the same bank. It seems distinctly possible that both forms of accounting could be in use by different institutions within the same banking system.⁵

⁵Banks that operate unified bookkeeping across all branches would be able to source larger loans, and could also be expected to cause higher monetary expansion rates as they take advantage of a larger liquidity channel with the central bank's clearing mechanisms.

4.3.2 Transfer between different Banks

Transfers between the main commercial banks, (clearing banks in the English system) take place through the central bank's clearing operations.⁶ Smaller banks may use accounts at larger banks, rather than direct access to the central clearing systems. In the example below we will show a transfer through the reserve accounts held at the central bank.

For a transfer from customer A.C1 of 1000 at Bank A, to customer B.C3 at Bank B:

Operations

- | | | |
|----|-------------------------------------------------------------|---------------------------------------------------------------|
| 1) | debit cash ledger
credit reserve at central bank | credit reserve ledger
debit central bank cash account |
| 2) | debit reserve account Bank A
debit customer account A.C1 | credit reserve account bank B
credit customer account B.C3 |

The operations are shown in more detail in Tables 4 and 5, which show a transfer of 20 from customer A.C1 at Bank A to customer B.C3 at Bank B.

Table 4: Transfer: Step 1: Move money to reserves

Central Bank		Bank A		
Assets	Liabilities	Assets	Liabilities	
		Loans	10000	5000 Deposit A.C1
				5000 Deposit A.C2
	220	Reserves	220	
420		Cash & Eq	780	1000 Capital
		Total	11000	11000
		Bank B		
		Loans	10000	5000 Deposit B.C3
				5000 Deposit B.C4
	200	Reserves	200	
		Cash & Eq	800	1000 Capital
420	420	Total	11000	11000

⁶Clearing operations today are usually performed through a real time transaction based system, but historically depended on an end of day exchange and balancing approach [8]. The exact implementation of the clearing operation, particularly with respect to its tolerance or otherwise for negative balances during the day, may have some systemic implications.

Central Bank		Bank A			
Assets	Liabilities	Assets	Liabilities		
420	200	Loans	10000	Deposit A.C1	
				5000	Deposit A.C2
		Reserves	200		
		Cash	780		Capital
		Total	10980	10980	
		Bank B			
420	420	Loans	10000	5020	Deposit B.C3
				5000	Deposit B.C4
		Reserves	220		
		Cash & Eq	800	1000	Capital
		Total	11020	11020	

Similar issues with liquidity considerations and activity that takes place between banks as opposed to those at the same bank can be seen with bank lending. Although banks have to assume that the money they loan may end up on deposit at another bank, and manage their liquidity exposures appropriately, many banks express a clear preference for lending to their own rather than other bank's customers, a preference that is also recommended in early banking literature. Both alternatives are detailed below.

Manuals on bank bookkeeping from the early 20th century indicate that the practice then was to enter the loan and the deposit simultaneously in the ledger books as shown here and there is no evidence that this practice has ever changed.

Bank Bookkeeping and Accounts, Meelboom (p35-p36) [9].

Operations	
1) debit loan ledger	credit customer account (e.g. A.C1)
2) credit cash ledger	debit reserve ledger

There are restrictions on the total amount of its loans that a bank can maintain. Under the Basel accords, it must be within its risk weighted capital restrictions, and it must also be able to meet the reserve requirement on its new level of deposits. To lend to another bank's customer, the bank must additionally have available liquidity for the transfer of money for the loan, and in practice since the bank must assume that its funds may be transferred to other banks, these considerations also apply to loans to its own customers.

Table 6: Loan to Bank's own customer

Central Bank		Bank A			
Assets	Liabilities		Assets	Liabilities	
410	210	Loans	10500	5500	Deposit A.C1
				5000	Deposit A.C2
		Reserves	210		
		Cash	790	1000	Capital
		Total	11500	11500	
Central Bank		Bank B			
		Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
	200	Reserves	200		
		Cash & Eq	800	1000	Capital
410	410	Total	11000	11000	

4.4.2 Lend to another Bank's Customer

Lending to a customer at a different bank by contrast requires use of the interbank transfer mechanisms and follows a different sequence of operations, as shown below.

Operations	
1) credit cash holdings at Bank A	debit reserve holdings at Bank A
credit reserve account at Central Bank	debit assets at Central Bank
2) credit reserve account at Bank A	debit reserve account at Bank B
debit loan ledger at Bank A	credit customer account at Bank B

Table 7: Loan to another Bank's Customer

Central Bank		Bank A			
Assets	Liabilities		Assets	Liabilities	
900	700	Loans	10000	5000	Deposit A.C1
				5000	Deposit A.C2
		Reserves	700		
		Cash & Eq	300	1000	Capital
		Total	11000	11000	
Central Bank		Bank B			
		Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
	200	Reserves	200		
		Cash & Eq	800	1000	Capital
900	900	Total	11000	11000	

This example also illustrates another feature of the system, that the creation of money in the form of customer deposit entries is independent of the money on deposit at the central bank (base money) and within the clearing system unless the system is operating at the limits of its reserve requirements.⁷

⁷In any banking system where accounts exist that do not carry reserve requirements (only Net Transaction Accounts require a reserve in the US system, while time deposits of greater than two years do not require reserves in the euro-zone), reserve limits effectively only throttle the system's deposit expansion rate, and do not set absolute limits on expansion.

Table 8: Loan to another Bank's customer					
Central Bank		Bank A			
Assets	Liabilities		Assets	Liabilities	
400	200	Loans	10500	5000	Deposit A.C1
				5000	Deposit A.C2
		Reserves	200		
		Cash & Eq	300	1000	Capital
		Total	11000	11000	
		Bank B			
400	400	Loans	10000	5500	Deposit B.C3
				5000	Deposit B.C4
		Reserves	200		
		Cash & Eq	1300	1000	Capital
		Total	11500	11500	

5 Interbank Loan

A loan to another bank is similar to a loan to a customer at a different bank, with side effects involving liquidity availability. It is accounted as a liability at the bank receiving the loan, and as an asset at the bank making it.

Operations

- | | | |
|----|----------------------------------------|----------------------------------|
| 1) | credit cash holdings at Bank A | debit reserve holdings at Bank A |
| | credit reserve account at Central Bank | debit assets at Central Bank |
| 2) | credit reserve account at Bank A | debit reserve account Bank B |
| | debit loan ledger at Bank A | credit loan liability at Bank B |

Table 9:					
Central Bank		Bank A			
Assets	Liabilities		Assets	Liabilities	
900	700	Loans	10000	5000	Deposit A.C1
				5000	Deposit A.C2
		Reserves	700		
		Cash & Eq	300	1000	Capital
		Total	11000	11000	
		Bank B			
	200	Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	11000	11000	
900	900				

Table 10:

Central Bank		Bank A			
Assets	Liabilities	Assets	Liabilities		
400	200	Loans	10500	5000	Deposit A.C1
				5000	Deposit A.C2
		Reserves	200		
		Cash & Eq	300	1000	Capital
		Total	11000	11000	
400	400	Bank B			
		Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
		Reserves	200	500	Loan from Bank A
		Cash & Eq	1300	1000	Capital
Total	11500	11500			

Table 11: Principal Repayment

Central Bank		Bank A		
Assets	Liabilities	Assets	Liabilities	
400	200	Loans	9960	Deposit A.C1
				Deposit A.C2
		Reserves	200	
		Cash & Eq	800	Capital
		Total	10960	
		Bank B		
400	400	Loans	10000	Deposit B.C3
				Deposit B.C4
		Reserves	200	
		Cash & Eq	800	Capital
		Total	11000	

Table 12: Interest Repayment

Central Bank		Bank A			
Assets	Liabilities	Assets	Liabilities		
400	200	Loans	9960	Deposit A.C1	
				5000	Deposit A.C2
		Reserves	200	60	Interest Income
		Cash & Eq	800	1000	Capital
		Total	10960	10960	
		Bank B			
400	400	Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	11000	11000	

7 Loan Default

Losses on loans are initially treated as an expense for banks, and are effectively deducted from income, but there are several stages to this process. Additional and potentially systemic complexities can occur if the capital reserve becomes involved. In general loan write-offs are a fairly predictable occurrence, several payments have to be missed before a loan can be treated as impaired. Banks are required to provision against potential losses on a loan at the same time it is made, and to continuously monitor and adjust loss provisions to match their anticipated losses. Banks also have some freedom on how impaired loans are treated, and may elect to write off all or some of the loan, or refinance it.

If loan losses and other expenses significantly exceed income, then the capital reserve is used to cover the write-off. With respect to the Basel Accord Tier 1 and Tier 2 capital lending provisions, the bank may be over capitalised, in which case there is a buffer of capital that can be used for this purpose without any impact on its ability to lend with respect to its risk weighted capital reserve multiplier. However, since banks must maintain a limit on their lending that is a multiple of their Tier 1 & 2 reserve funds, if losses are sufficiently high they can push the bank out of regulatory compliance, since it will no longer meet its capital requirement. This last situation is rarely recoverable without external intervention.

The bookkeeping arrangements that are used to represent the first part of this process use a contra-asset account for loan losses, which is then subtracted from gross loans.⁸ In the example below, we will begin with showing

⁸A contra-asset account is an asset account which has a credit balance, normally asset accounts maintain a debit balance. The contra-asset

When the bank then writes off part of its loan book (50 in the example shown in Table 15, the loss provision account is reduced by the amount of the write-off, as is the loan book. Strictly, the loss provision account is debited, reducing its balance, and the loan account is credited, also reducing its balance, since it is an Asset account. The net balance of the Assets is unchanged as a result, since the loss provision account has already accounted for the write off [10].

Operations

- | | |
|---------------------------|--------------------------------|
| 1) debit interest account | credit loss provisions account |
| 2) credit loan amount | debit loss provisions account |

Central Bank		Bank A			
Assets	Liabilities	Assets	Liabilities		
400	200	Loans	9960	4900	Deposit A.C1
				5000	Deposit A.C2
				60	Interest income
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	10960	10960	
		Bank B			
400	400	Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	11000	11000	

12

Central Bank		Bank A			
Assets	Liabilities		Assets	Liabilities	
400	200	Loans	9960	4900	Deposit A.C1
				5000	Deposit A.C2
		Loss provision	(50)	10	Interest income
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	10910	10910	
		Bank B			
400	200	Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	11000	11000	
400	400				

Central Bank		Bank A			
Assets	Liabilities		Assets	Liabilities	
400	200	Loans	9910	4900	Deposit A.C1
				5000	Deposit A.C2
		Loss provision	(0)	10	Interest income
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	10910	10910	
		Bank B			
400	200	Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	11000	11000	
400	400				

8 Increase Capital

The capital holdings of a bank are initially the shares purchased by its stockholders when the bank is founded. The money received by the bank for this purpose becomes its asset cash holdings. Although the tradable price of shares varies with stock market conditions, the book value used for common stock held in the bank's capital is the money received by the bank and initially entered into its cash asset ledger.

Under Basel, capital holdings are divided into two Tiers with regulated definitions for the financial instruments that can be held in the different tiers, and separate ratios for the loans that can be extended against their capital holdings. Broadly, Tier 1 consists of common stock and disclosed reserves or retained earnings. Tier 2 holds undisclosed reserves, revaluation reserves, additional reserves for loan losses (holdings additional to the loss provisions described above), and subordinated debt. (Subordinate debt is money that has been borrowed by the bank, but is subordinate to the claims of the depositors on bank funds.)

Basel 2 included a Tier 2 category of "hybrid capital instruments" which are financial instruments having qualities of both debt and equity. The category has proved somewhat controversial, with a number of such instruments being explicitly forbidden by the regulators, and appears to be being removed in Basel 3.

There appear to be no restrictions or controls on increases to the capital reserve, which can be done from profits, but liquidity would be required for any purchase of financial instruments such as government treasuries. Since sales of bank stock add to liquidity, this restriction would not apply to that channel.

the deposit holder of account A.C1.

Operations	
1) debit from account A.C1	debit reserves at Bank A
credit capital	credit reserves at Bank B

Table 16: Sale of Stock to increase Capital

Central Bank		Bank A			
Assets	Liabilities	Assets	Liabilities		
400	150	Loans	10000	4950	Deposit A.C1
				5000	Deposit A.C2
		Reserves	150		
		Cash & Eq	800	1000	Capital
		Total	10950	10950	
		Bank B			
400	250	Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
		Reserves	250		
		Cash & Eq	800	1050	Capital
		Total	11050	11050	
400	400				

9 Borrow from Central Bank

Central bank operations are in principle no different to other bank operations, but operate from a privileged position in the system with respect to the other banks.

Operations	
1) debit Central Bank Assets (loan)	credit reserve account for Bank A
debt reserves at Bank A	credit loan to Central Bank

Central Bank		Table 17: Loan from Central Bank			
Assets	Liabilities	Bank A			
		Assets	Liabilities		
600	400	Loans	10000	5000	Deposit A.C1
				5000	Deposit A.C2
		Reserves	400	200	Loan from Central Bank
		Cash & Eq	800	1000	Capital
		Total	11200	11200	
		Bank B			
	200	Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	11000	11000	
600	600				

10 Payment of interest on reserve holdings by Central Bank.

Payment of interest on the reserve holdings is a necessary feature of the system, otherwise systemic imbalances would result over time from the asymmetric flow within the system as central bank loans were repaid by the clearing banks. In the example in Table 10 it is assumed that 10 has been received by the Central Bank as interest payment on its loans, and this is now paid to Bank A as interest on its reserves.

Operations	
1) debit Central Bank Assets (money)	credit reserve account at Bank A
debt reserves at Bank A	credit income received at Bank A

Central Bank		Table 18: Initial Position			
Assets	Liabilities	Bank A			
		Assets	Liabilities		
410	200 10	Loans	10000	5000	Deposit A.C1
				5000	Deposit A.C2
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	11000	11000	
		Bank B			
410	200	Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	11000	11000	
410	410				

Table 19: Payment of Interest on Reserves					
Central Bank		Bank A			
Assets	Liabilities		Assets	Liabilities	
410	210	Loans	10000	5000	Deposit A.C1
				5000	Deposit A.C2
		Reserves	210	10	Income
		Cash & Eq	800	1000	Capital
		Total	11000	11000	
		Bank B			
410	200	Loans	10000	5000	Deposit B.C3
				5000	Deposit B.C4
		Reserves	200		
		Cash & Eq	800	1000	Capital
		Total	11000	11000	
410	410				

11 Reserve Holdings

Two forms of reserve holdings exert regulatory control within the system. The capital reserve regulates the total amount of loans that can be made by the bank, while the reserve held at the central bank, in principle at least regulates the amount of deposits that the bank may hold. Potentially, as lending is also linked to deposit creation the central bank reserve can exert some regulation over lending as well. For this to occur however, two conditions

have to be true. One is that the central bank reserve requirement is greater than the capital reserve requirement, otherwise the capital reserve requirement will dominate. The other is that the reserve requirement is applied to all deposits accounts without exception. Consequently the regulatory effect of the central bank reserve can be diluted in practice. A further consideration, with systemic implications, is also the mechanisms by which banks are allowed to increase their central bank reserves. In the USA it seems this can be done through the deposit of government treasuries, which in practice would remove systemic control over the quantity of reserves in the system.

References

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